



MISSOURI BOTANICAL GARDEN

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GEORGE ENGELMANN BOTANICAL NOTEBOOKS

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Sept 23 1869

As *Cryptaese* can be preserved only very imperfectly in the Herbarium, it is necessary to draw up a description on the spot - for which the following directions will be found useful.

Note, as with all other plants, the locality where the plant grows, is moist or dry, shady or sunny places, in sand or on rocks; also the period of flower ing and of the maturity of the fruit.

Vegetative parts of the plant

1. The trunk : shape (globose, or depressed, or oval, elongated, uniform or jointed, simple or branched (and form and direction of branches); erect, prostrate or climbing, with or without aerial roots; terete, or ribbed, or winged, or compressed; or covered with tubercles (called mamillae); if ribbed or compressed, the angles ought to be described; they are sharp or rounded, and (seen in profile) sinuate or crenate. The grooves between the

angles are shallow or deep. Best give a rough sketch of
2. Leaves see below epidermis rough or pubescent, rarely smooth.
3. All Peat-leaves ~~pass~~ more or less woolly (more or less) buds,
called areoles from which bunches of spines or
flowers or both. These areoles furnish a important
character, and it is necessary to note if this
portion, other prominent or increased
arrangement, shape (circular or oval or
peninsular or flat)
elongated) size and usual distance from one
another. Their condition in youth and age,
and their coating with tomentum or wool of
different colors.

"p. On these and on the species are found the
characteristics of the whole family. The
species are extremely ~~variable~~ in shape



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Directions slender, brittle, wiry, robust
of size and number; they are straight or curved
or hooked or compressed, terete or angular & smooth or annulated,
and of different colours which it is well to
note. They are often arranged very regularly
which can be best illustrated by Diagrams giving
also the shape of the awola, for example 
or more or less regularly. An important
character is their stability or change with
age; for many species, ^{and continuing to vegetate, the} the size of the awolas
and the number of spines increases with
for many years ^{age} while in others, once formed, they never
~~never increase~~ change, and only drop off with age. The flower and
2, ~~Seeds~~ are found only on the Opuntiae and
Pitcairnia; in the former they are always
located on slightly compressed ^{subulate, nearly cactus, quite caducous} the latter flat,
and somewhat ^{throughout the season} pointed. The leaves of
Opuntiae, uniform as they seem to be, furnish
some characters by their size and direction of
(adpressed, spreading, or curved)

II Appendix Part II of the Plan

1. Flower. The flowers are produced from some of the buds (arolae) usually on parts of the plant not differing from the sterile ones, in some genera however, the flowering part widely differs from the sterile one, this is the case especially in Melastomae, and in Stelis it is usually called Floriferous.

The flowers ~~begin~~ sprig for the year, now out,
are older, just formed or forming. Therefore
at or near the apex of the plant and from the
new mouth of the fast few weeks past



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or, more commonly
are produced from the older parts of the plant, from the
sides of the growth of the previous season, therefore not
very far below the top, or from the sides or even
the lower part of the trunk or branches, from buds
which are many years old. in *Opuntiae* they sprout
from the sides and top of the joints of the previous year,
(therefore never bearing leaves)

The flowers are single or very rarely
several from one areola
not resubtite ^{but} They open in daytime - full ^{but} in a light,
(closing in the afternoon, as *Echinocactus*, *Opuntiae*
& others, or they remain open ^{whether} day and night
(as in some *Cerei*) or they ~~open~~ ^{with expand} at night, &
close ~~at~~ by light or at least before noon

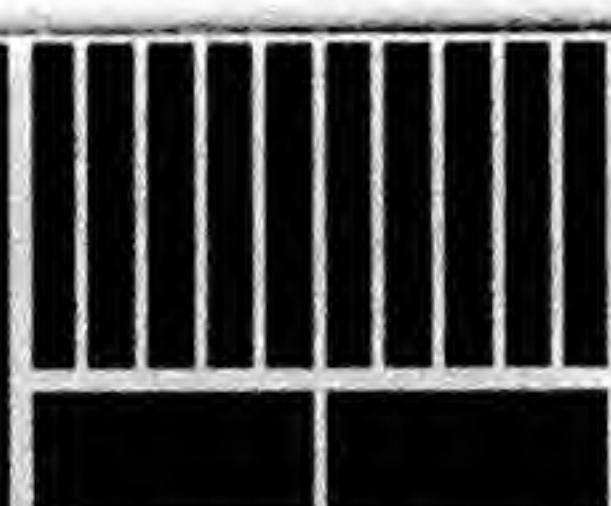
It is of course important to note the
size and shape of the flower ^{the} whole length,
the length of the tube and the ^{diagram} width of the fully
open flower; and also its colour & its fragrance.

The parts of the flower are very little known
- *Carl* and it is so much more important
to make them minutely as dried specimens
furnish so little help.

a. ovary (always inferior) its shape, size,
naked or coated with few (?) or many (?) processes
(not number) sepals; these sepals are small,
scale-like, or thick and fleshy, or foliaceous; their
axils naked or providing wool hair or spines.

b. tube of flower.

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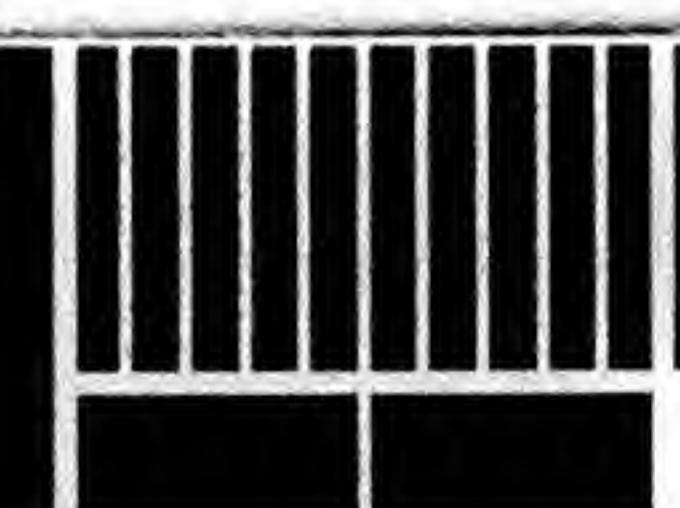
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Instructions for those that have an opportunity
to observe or collect Cacti in the field.

The first thing you observe
in a Cactus are the spines
see page 3 You find these spines in
bunches together.

These bunches are disposed
grow from a well marked
spot, which is called the
areola; this spot is when
young generally covered with
white or coloured wool,
(which after some time disappears)
or with sharp bristles (in the
genus Opuntia). The areola is
round or oval or elongated,
linear etc.

The areolas with their spines
are disposed in ~~vertical~~ or
~~on the~~ spine rows, ridges on
they ~~are~~ are ~~each~~ found
supported by a shorter or
longer tubercles, ^{mention above} or they
are disposed over the
more or less smooth surface
of the plant, ~~it~~ spirally
~~arranged~~ ~~times~~ without any
prominent ridges or tubercles.

The spines themselves
are of very different shape
size length and strength: Generally
we find some more central
and others ~~dry~~ spreading like
see page 3



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The first thing you observe in a Cactus is the shape

It is either more or less globose, oval or flattened, simple or ^{simple or} ~~proliferous~~ (that is to say, producing short branches) cylindric, roundish or angular, erect or prostrate or even climbing; simple or branching; — or it is jointed; the joints are flat, leaflike, or they are more or less round (cylindric).

The globose Cactus plants show either ridges with corresponding grooves between them or they are covered by tubercles.

The ridges are straight or more or less spiral, they are sharp, or rounded, uniform ^{straight} or wavy or interrupted. The grooves are also deep or shallow, wide or sharp.

they show considerable constancy in their number; some Cacti have 3, 4, 5, 6, 7 and 8 ridges or ribs; from that the number frequently rises to 10, 12, 18 and 21.

The tubercles are longer or shorter, from almost spherical to cylindric to finger-shaped, they are always spirally disposed. They are round or angular, or grooved on the upper side; smooth naked or woolly in their axills.

The cylindric Cactus plants are almost all more or less grooved or angular, and

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in regard to them.

I have to repeat what I have just said about the characteristics of the ridges and grooves.

The jointed Cactus plants are flat like the common probably pear or round, stem-like. — The shape of the joints, and the surface whether smooth or more or less uneven by tubercles, furnish many differences.

I come now to one of the most important characteristics of the Cactus tribe. The spines.

We find the ~~weakly~~ single, generally they are ~~weakly~~ together.

wide p. 1.

on the page 1. rays — and generally the central and radial spines are of different shape & size and of colour.

The spines are round or flat or angular; they are smooth or annulated (transversely grooved); straight, curved or hooked, white, yellow, brown or black.

The flowers are produced either from the growth of the same year or from that of former years. (from the older part of the plant). In the first case



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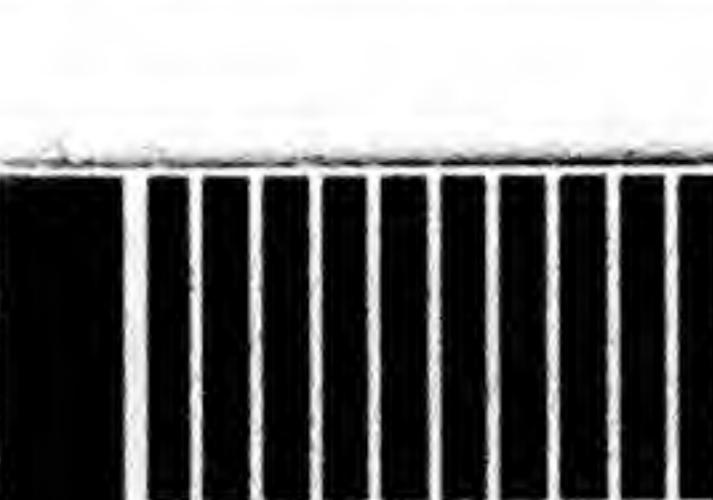
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they are found at or near the top;
in the latter case more or less on the
sides of the plant. ~~The~~ ~~the~~
The flowers of the same year's
growth are found either on
sides on the top, in the centre
of the plant (they are ^{then called} vertical) or central
or they are more or less ^{In the first case the plant does not grow further} lateral near the top. — The till ~~of~~ off the blooming or at even
till next spring. — In the second case
flowers either come out at it continues to grow and to
once or at least within a few develop new tubercles or branches
weeks, — in the spring or early of spines etc., which push aside
summer, or they are produced the originally central flower bud.
throughout the season, in which
latter case, flowers and fruit
will be found on the same
plant at the same time.

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The Cactus flower has
an inferior ovary (or fruit bud) ^{not included in the flower}
this is naked (Mammillaria) ^{but supporting the same}
or covered by scales (Echinocactus)
or woolly, hairy and spiny or elevated
areolae (Cereus) or bearing
small ^{sharp} awl-shaped
tentacles (Opuntia). These are
the only to ^{genera} found I know of
so far in the extra-
tropical parts of North America.

The numerous ^{ves} leaves of the
flowers form either a tube
which is in most of our Cacti
short and ~~compound~~ bell- or
funnel-shaped or long, tubular
as in many southern species —
or it is entirely wanting

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in all *Opuntiae*, where the flower when fully open is flat, ~~without~~ ^{rotately} like a plate, without any tube.

The leaves forming the flower may be divided in the outer coarser mostly ~~smaller~~, and more or less greenish ones, sepals, and the inner ~~thinner~~ more delicate ones of more beautiful colours, the petals. —

The flower includes numerous stamens, and in the centre the style, which is as long as the stamens or more or less elongated; it is at all ~~apart~~ separated into a number of partitions, the stigmata, which are of different colours and are erect, or recurved, or cup shaped etc. —

The fruit of the Cactus is ~~of~~ different shape, and colour ^{smooth} ~~naked~~ or covered by scales (of very thin ones) or bristles or wool etc. The fruit has ~~been~~ on top the withered flower or it is naked, in the latter case it generally ~~has~~ ^{has} a more or less large and deep mark where the flower has fallen off.

The ~~first~~ size fruit is either juicy or dry; it contains few or many seeds, of different colour and shape, smooth, or wrinkled, or pitted or warty; even or uneven.

(umbilicus)



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Opuntia coccinellifera Mill.
= *Cactus coccinellifer* Lin
in *gen. Cactus* inf. Clapp.

After having examined in this manner the most important parts of the *Cactus*, I shall now proceed to state the principal divisions of this family, as far as they are important for the extra-tropical regions of North America. —

1. Mammillaria. Plant more or less globose, or oval, or short cylindrical, covered with tubercles, which bear spines on their tip and are arranged in spiral rows. — The flowers are produced mainly from the growth of the same year, rarely from that of the preceding year. The flowers have in the former case a central position on they are more lateral, being pushed aside by the continuation of the growth of the plant at top.

The ovary of the flower is naked, that is, it is not covered by scales or bristles. The tube of the flower is short, and the fully open flower is more or less bell shaped. The fruit is either red or green. In the former case it is less globose, or ^{long} clubshaped, or the fruit is green and then always crowned by the flower ^{remnant of the} as far as I have ascertained, and of an oval shape.

O. Tuna Mill. B.C. July, 1809
= *Cactus Tropaeolum* Thunb.
O. Nopalilla Karw. ^(H. aurantiac)

Humboldt fifth and 15
Cactaceae 2 and nine
Opuntia 12, 2 *prolificae*
10 *Cerei* 22 2 *hippocratei*.
Woldeanum Thunb 1799 and 29
Actin.

plant mostly small
a few inches in diameter.

The plant is simple or branching and ^{and} ~~prolific~~
are always found in the axils
of which the tubercles form with
the body of the plant; they



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smooth or pitted

+ always simple

areolar approach or distant

The plant is always simple normally only apparently branching, when wounded or otherwise injured. Their size is larger than the Mammillaria for a few inches to several feet - diameter. 6-16 inches - the usual size.

* its color is yellow ^{more rarely} red or whitish



The seeds are black or brown or yellowish, globose or long.

2. Echinocactus Plant more or less globose, or flattened, or oval, + bunches of spines in vertical or more or less spiral ridges or ribs, ribs ^{and grooves} _{between them} as above stated of different shape, thick or thin, sharp or rounded - even or wavy or more or less interrupted (this is especially the case in young plants, where the ribs are sometimes almost separated, into distinct tubercles, somewhat like Mammillaria) #

The flowers are always produced from the same year's growth, crowded together at the top ^{Distributed rather} or produced more laterally. but always The ovary is covered by thin or hard scales or bristles and wool. The flower is short, ^{bell or funnel shaped} ~~cupulate~~ when fully open, which as in Mammillaria is only the case in the middle of the day in bright sunshine. The fruit is dry, hard or juicy always crowned by the withered flower. The seeds so far as I have seen are always black, ~~yellow~~

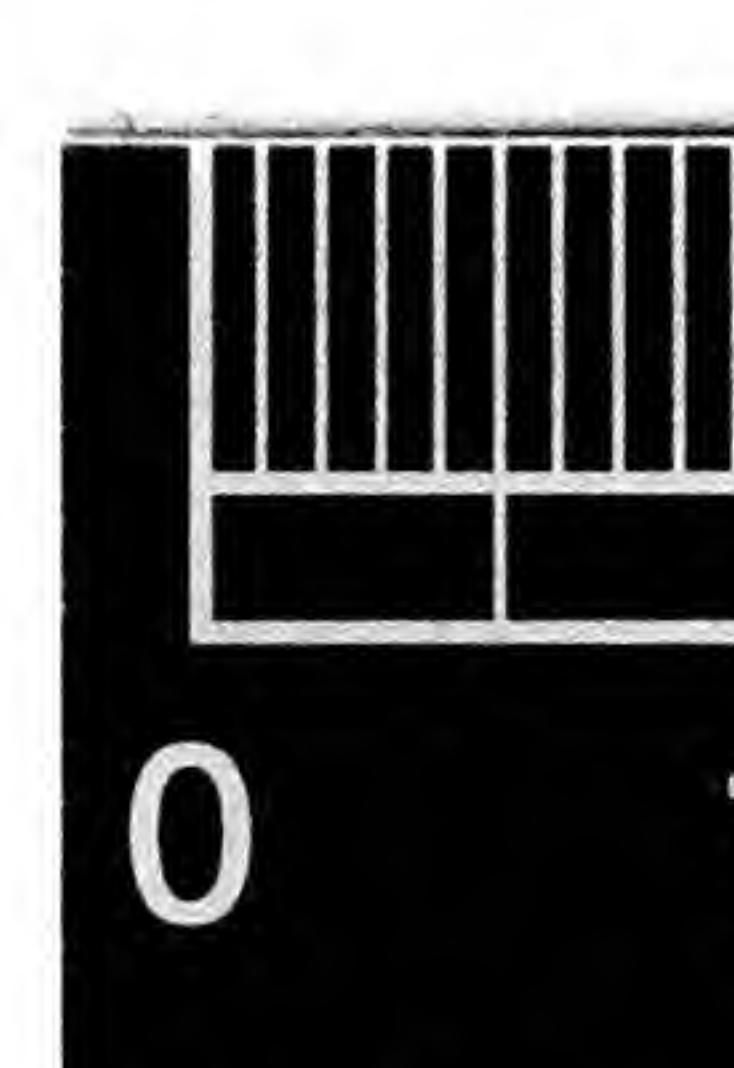
B. The genus Melocactus occurs only in tropical climates, generally near the sea coast.

It resembles in shape very much the Echinocactus, but the plants of this genus push when they are going to flower push from their top, a woolly body, with tubercles from which the flowers are produced. It looks like a woolly Mammillaria growing from an Echinocactus.

3. Cereus plant more or less cylindrical, often short, oval, or even ^{almost} globose, but mostly long, erect or spreading, rarely single, mostly branched, often many stems from one base. Body angled or ribbed, flowers always from the growth of the ~~last~~ preceding or former years, & for a few inches to many (over 20-60) feet high, from a few inches to several feet in diameter. Ovary and tube covered by woolly (somewhat elevated) arecolae (see above) which produce bristles or spines; the upper tube of flower short, funnel or bell-shaped or long, oft very long, flower open day and night, or night only or with middle of the day only and in bright sunshine only; — fruit so far as I know more or less juicy with or without the remains of the flower. Seed black.

Most of the northern Cerei are ~~less~~, of short, low stature, resembling Echinocactus in shape, and have flowers & short, bell-shaped which open only in sunshine. But they ~~branching~~ are branching, or ^{more or less} creeping.

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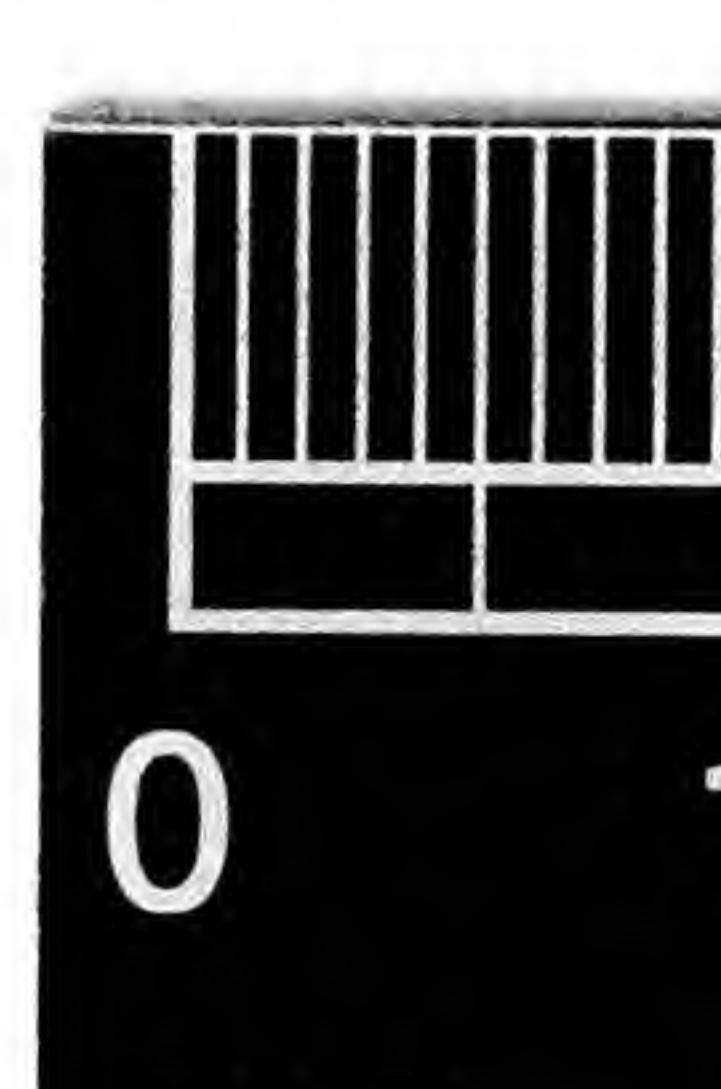
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~~is~~
growth, their flowers are produced laterally from last year's growth, and their ovary and flower tube is covered by bristly or spiny areolae. By these characteristics they are easily distinguished from *Echinocactus*. I had separated them from *Cereus* proper under the name of *Echinocereus*, but think it better now to re-unite this section with *Cereus*.

St. Opuntia plants jointed, joints flat, leaflike or round, stemlike; ^{areolae with} ~~bottoms~~ ^{bottoms on} spines ~~bottoms~~ spread over the more or less even surface, or on more or less prominent tubercles, never however in the shape of mammillaria. On the areolae mostly small barbed bristles which adhere to the skin, stronger spines also barbed therefore much more disagreeable than the other Cacti. Spines sometimes covered with a thin membranaceous sheath.

Flowers from the growth of the last preceding year. — ovary with small round leaf-shaped leaves with areolae ~~which are~~ woolly, bristly or spiny areolae. Flower perfectly open in sunshine without a tube saucer-shaped or flat, mostly yellow, also red.

+ This is the only genus of those here mentioned which show a semblance of leaves. The young joints ~~have~~ at the lower part of each areola a small round oval-shaped leaf (smooth like the leaves of which after a few months drops off.)



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Fruit juicy or dry, smooth or bony or spiny, with a large scar on top, where the flower has fallen off. Seeds mostly white, flat bony uneven, larger than in ^{most} any other *Castor*. —

The *Osmundaceae* are easily separated into two tribes, the flat jointed and the round jointed or stem jointed. —

prostrate on the ground or erect a few feet to 20-30 feet high, tree-like

After having given you now a general view of the different forms of the *Castor* I proceed to state, what you have to pay particular attention to in collecting *Castor*, living ^{other} ~~and dead~~ or dead — 2, in figuring them, 3, in describing them.

Description. — dimensions, as colour, and you notice the shape, whether single or branching etc., the number of spiral rows of tubercles, or of ribs, the shape ~~and~~ of the tubercles, ribs and ~~grooves~~ ^{on} distance of the the hair axils of the tubercles, whether smooth or woolly, the appearance of the top, ~~and its~~ whether depressed or not woolly or not. You observe and notice the shape of the Arcolae and their distance from one another;

Describe the spines, their direction, number, length, strength,



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x) where produced central, lateral, ^{last year's} fifth year's on the same year's growth.


shape, direction and colour. Flower's size, shape and colour; ovary, shape and number of exterior sepals, on the leaves, or areolae, which are found on the tube on the ovary and the tube; — shape number and colour of the inner sepals, (the outer greenish coarser leaves of the crown of the flower) — shape number and colour of the petals, or inner, delicate flower-leaves. — Colour and length of stamens, — — — Proportions and shape of style, number, shape and direction and colour of stigmata. —

Fruct — shape, covering, colour, whether the remains of the ^{flower} corolla are on it or not; how the scar, left by the corolla, is shaped —

Seed shape, size, colour, etc. —

Figuring.

Besides a general view of the plant it would be well to figure at least of the more or less globose ones, a vertical section, and a horizontal section, at least of a segment, so that the exact shape of the plant, and the number and shape of ribs & grooves may be



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exhibited.
 distinguished; figure also two or three tubercles ~~and~~ a piece of a rib with 2 or 3 areolae and bunches of spines separately as in natural size. — Of the flower give, if possible, also a vertical section, so that the interior parts may be well seen, especially the shape of the flower, the stamens and style and stigma, and their relative proportions. —

Collection

~~To preserve the live plant~~

The living plant can be preserved for 6 to 16 months, ~~for~~ that purpose it is best to collect the — fall or winter — either the whole plant with root, or merely joints or cutts (of the branching ones)

These specimens selected for transportation ought to be sent left for some weeks ⁱⁿ the shade to wither, they may be wrapped up ~~then~~ in dry hay or moss and packed together but not too tight nor ⁱⁿ too close a box, that they may not moulder. —

Middle sized or young specimens ought to be selected; as they grow better than old plants.

These plants are also easily ~~transplant~~ raised from seeds.

These seeds must be preserved ~~late~~ all other seeds; — they are best

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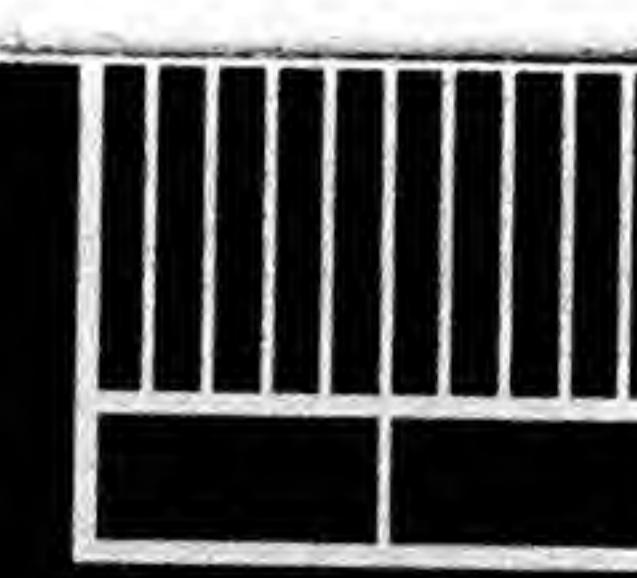
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kept by drying the fruit with containing them, whole or cut in slices, if too juicy. They keep much better in the fruit. They must not be packed airtight but must be kept from moisture. For the herbarium the flower must be put up as other flowers are; — it is well to split some open. — The fruit if not too large, can also be pressed and also a slice of the plant, if the whole, or half is too bulky; for smaller ones it is well to cut off a part, showing the top, the insertion of some flowers, some tubercles or ribs and several bunches of spines. — Larger ones will only permit to cut off a few ribs, together, or ~~separately~~, but always from the top to some distance on the side. — If the means of transportation permit, it is well enough to put away a larger slice dried (not pressed) where the position and direction of spines can be seen etc.

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Collection of woods.

Of smaller stems, shrubs, take a section of the whole stem, about a foot long. Of large ones take one half; of still larger trees, take a segment which ~~cuts out~~ shows the bark, outer and inner wood, if possible to the centre. —

Of interesting or valuable woods it would be well to bring along larger specimens, so as to that they can be put to use or trial and practically tested. —

Seeds

Valuable seeds especially such of trees, pine seed, acorns etc. may be best preserved by mixing them well with dry sand.

and seed, of other probably interesting plants.



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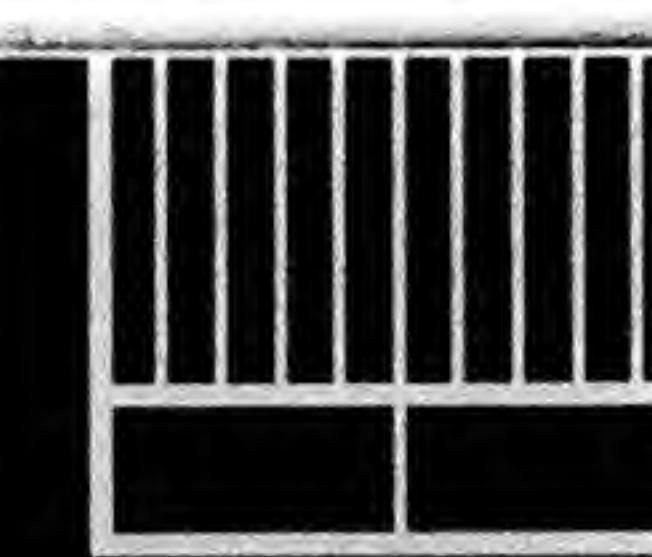
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In the botanical collector's pay particular attention not only to the flower but also to the seeds — obtain fruit & seed, whenever possible for they are of the highest importance. —

It is also important to have the root or at least the base of the plant, so that the nature of that organ can be ascertained, also whether the plant has an annual or a perennial root. —

Observe the direction of the pine cones on the branches whether upright or pendulous, or ^{spreading} standing off the stem in a greater or smaller angle.



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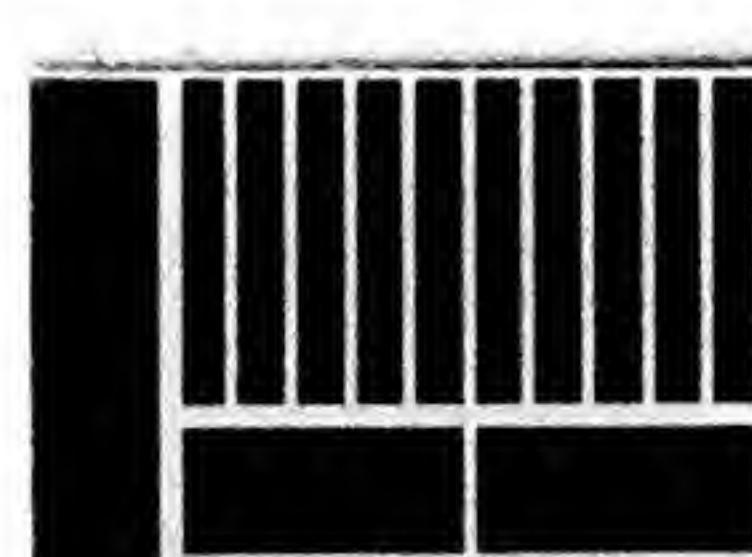
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